March 3rd, 2016

Release Notes for the DPR Level 2 and 3 products

DPR Level 2 and 3 Version 4 products have been released to public users since March 2016.

Caveats for these products are described as follows. All users can keep them in mind when they use the data.

＜Changes for DPR Level 2 products from Version 3 to Version 4＞

- Preparation module (PRE)
  - Noise power calculation (no net change).
  - Clutter-free bin moved up one 125m bin away from surface.
  - Add sea-ice information for Ku.
  - Rain/no-rain judgment adjustment to find lower rain.
  - Improve Ku sidelobe correction.
- Vertical Profile Module (VER)
  - Revised cloud liquid water database
  - Bug-fixed
- Classification module (CSF)
  - Ku: update of BB detection
  - DPR: Bug fix and new DFRm parameter values.
    - Difference between Ku-only result and a dual frequency result (DFRm result) becomes smaller.
    - Added value to 6th bit (0-based) of typePrecip for DFRm precip type:
      - 8: DFRm skipped at Part A,
  - Format changes :
    - DPR HS: Added two items: binDFRmMLBottom and binDFRmMLTop
    - DPR MS: Changed names from binDFRmBBBottom and binDFRmBBTop to binDFRmMLBottom and binDFRmMLTop, respectively.
    - Note: ML stands for Melting Layer.
- Surface Reference Technique (SRT) module
  - Temporal reference files implemented.
  - DJF, MAM, JJA, SON

- Solver module (SLV)
  - R-Dm relation as new constraint of DSD
  - Adjustment (epsilon) fixed per ray.
  - Non-Uniform Beam Filling (NUBF) added.
  - dPIA directly used in SLV module.
  - Missing echo compensation added for Ka.

＜Changes for DPR Level 3 products from Version 3 to Version 4＞

- L3DPR full daily and monthly product
  - Instrument and Channel index increased.
  - Added statistics for Ku data restricted to MS swath.
  - Instrument: Ku, Ka, KaMS, KuMS
  - Channel: Ku, Ka, KaMS, DPRMS, KuMS

＜Caveats for DPR Level 2 products by DPR Level 2 algorithm development team＞

1. Preparation module (PRE)
   Mainlobe clutter may be occasionally misjudged as a strong precipitation echo in some areas, in particular in Greenland and in Antarctica where the accuracy of the digital elevation map (DEM) used in the algorithm is not good. It is expected that such misjudgment is very infrequent.

   Sidelobe clutter contamination has been reduced to a satisfactory level at most occasions. However, significant sidelobe clutter remains at exceptional places such as over a very calm sea and some ice-covered land, for example, in Northern Canada.

   "flagEcho" provides information related to the mainlobe and sidelobe clutter. Please see Appendix A for details.

2. Classification module (CSF)
   The detection of bright band (BB) in the outer swath of Ku-band data is not effective yet. Improvement of BB detection in the outer swath remains to be an issue.

   The Ka-band BB detection and rain type classification may not be reliable because of attenuation, sensitivity, and so on.

All the shallow rain is classified as convective in the unified rain type.

Sidelobe clutter influences the Ku-band shallow rain statistics significantly. When taking rain type statistics such as the dependence of each type count on the angle bin, you should treat the shallow rain count separately. (This suggestion applies to the Ku-only products and DPR NS products.)

Rain type classification in the snow-only or near snow-only case has become a big issue. It is planned to solve this problem in the next version.

3. Solver module (SLV)

The upper limit of D_m estimate is 3.0 mm, but heavy precipitation may have D_m of larger than 3.0mm. This may cause underestimation of D_m and overestimation of precipitation rate R. When D_m takes the value of upper limit, the 5th and 6th bits of flagSLV are 0 and 1 (or the remainder of flagSLV divided by 64 is between 32 and 47). In the next version, the upper limit of D_m should be set higher.

The parameter epsilon (ε), which is used to adjust R-D_m relation in version 04, never change along the beam, though it can change along the beam in the version 03 of dual-frequency algorithm. To estimate ε at each range bin, HB-DFR method was used for version 03, but the results were not very stable and not so good as expected. Therefore, in version 04, ε is estimated for a beam (pixel). The idea of HB-DFR method is partly used to determine the value of ε in dual-frequency algorithm. In the future version, dual-frequency technique should be used to estimate the vertical change of ε.

＜Appendix A:　Details of “flagEcho”＞

flagEcho is a 1-byte integer variable, and its array size is nbin x nray x nscan. Here, nbin is the number of range-bins, nray is the number of angle bins, and nscan is the number of scans in the granule.
The meaning assigned to each bit in the flagEcho is summarized in Table 1.

flagEcho provides the following information.

- Classification of precipitation/no-precipitation at each range-bin (bit 0-3). However, the final judgment of precipitation/no-precipitation in the L2 product is provided by flagSLV (its bit 1).
- Detection of mainlobe clutter (bit 4-5).
- Application of a routine to reduce the sidelobe clutter (bit 6-7)

Figure 1 shows an example of a vertical cross section of the flagEcho.

Table 1. Meaning assigned to each bit in flagEcho

Bit	0	1
bit 0	-	precipitation @ DPR or Ku or Ka
bit 1	-	precipitation @ DPR
bit 2	-	precipitation @ Ku
bit 3	-	precipitation @ Ka
bit 4	-	mainlobe clutter @ Ku
bit 5	-	mainlobe clutter @ Ka
bit 6	-	sidelobe clutter @ Ku
bit 7	-	sidelobe clutter @ Ka

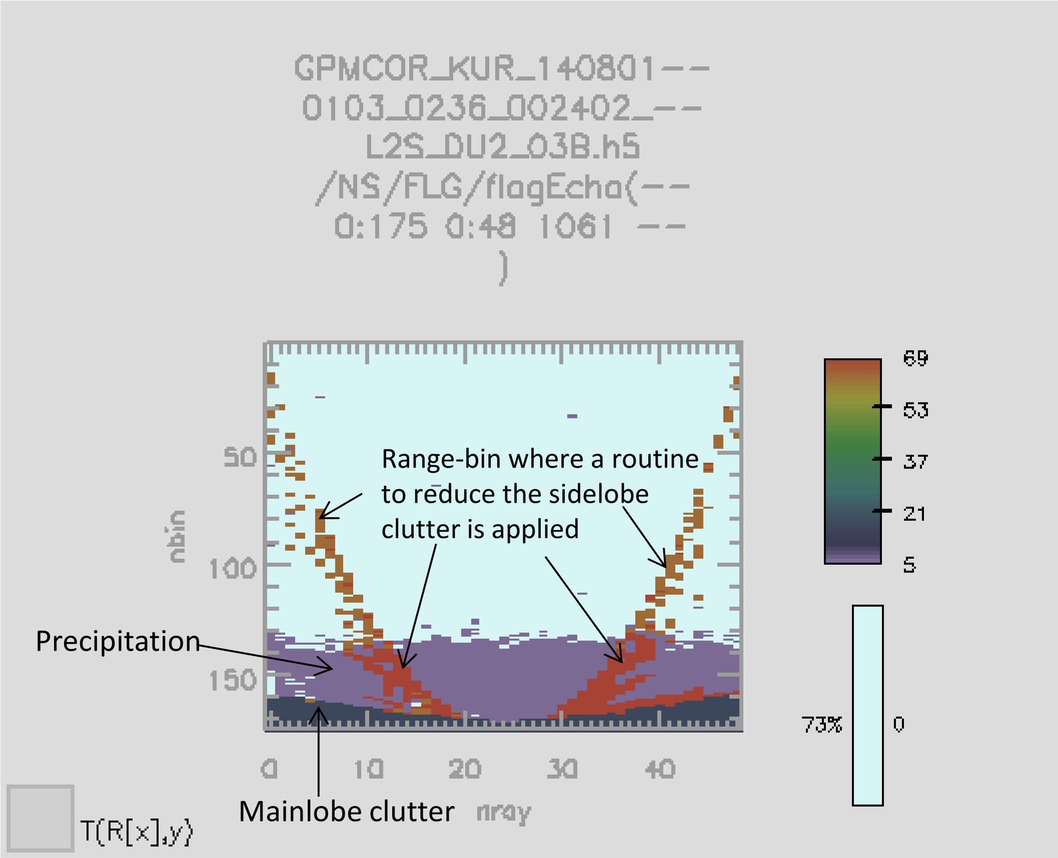

Figure 1. An example of a vertical cross section of flagEcho. The horizontal axis denotes the angle bin number and the vertical axis denotes the range-bin number.

While sidelobe clutter remains at some places, the bits in flagEcho that indicate the existence of possible sidelobe clutter may be useful for analyses of KuPR radar reflectivity.